

CLAIMS

1. Electrical cell for the propulsion of a device in an aquatic medium, characterized in that it comprises at least, in a sealed cell body:

- a first chamber forming a housing comprising an auxiliary electrical cell and a command and control module for the electrical propulsion cell;
- a second chamber forming a housing comprising a main electrical cell of the electrochemical type, said second chamber being provided with members for the controlled admission and the regulation of a flow of water from the aquatic medium into said second chamber, which forms a reservoir, in order to form, after the command to admit water from the aquatic medium, an electrolyte for activating said main electrical cell;
- a third chamber forming a housing comprising a module for triggering the admission by suction of water from the aquatic medium and the discharge by escape of effluents resulting from the chemical reaction of the main cell into the aquatic medium, from an admission valve and an escape valve, respectively, which are mounted in said third chamber, said command and control module of the electrical propulsion cell permitting the activation of said auxiliary electrical cell in order to generate electrical energy temporarily during a stage of launching said device in an aquatic medium, and the triggering of the admission by suction of water from the aquatic medium and of the discharge by escape of effluents in order to produce electrical energy from said main electrical cell during a cruise phase.

2. Electrical propulsion cell according to claim 1, characterized in that said auxiliary and main electrical

cells are controlled sequentially by said command and control module of the electrical propulsion cell and are connected respectively to a main and secondary electrical energy distribution network.

3. Electrical propulsion cell according to either claim 1 or claim 2, characterized in that said auxiliary electrical cell is formed by a set of thermal cell elements started up by pyrotechnic ignition.

4. Electrical propulsion cell according to any one of claims 1 to 3, characterized in that said members for the controlled admission and the regulation of a flow of water from the aquatic medium into said second chamber comprise at least:

- a motor-driven pump unit, the suction nozzle of which is connected to said valve for the admission of water from the aquatic medium, and the outlet nozzle of which delivers the water sucked in from the aquatic medium directly into said second chamber forming a reservoir, in order to form said activation electrolyte and to immerse said main electrical cell in the latter;
- a thermostatic valve connected to said main electrical cell, said thermostatic valve regulating the admission of said activation electrolyte into said main cell in order to trigger the activation of said main electrical cell by electrochemical reaction;
- a device for the circulation of the activation electrolyte and the separation of the effluents, said device for circulation and separation comprising an inlet nozzle connected to the internal cavity of said main electrical cell, containing the activation electrolyte, a first outlet nozzle connected in the vicinity of the admission nozzle of the motor-driven pump and a second effluent outlet nozzle

connected to said discharge valve located in said third chamber.

5. Electrical propulsion cell according to claim 4, characterized in that said second outlet nozzle of said device for circulation and separation is connected to said discharge valve located in said third chamber by means of a mode valve which permits the orientation, in a first position, of the effluents towards the effluent discharge valve when the main electrical cell is started up during the launch phase, and, respectively, in a second position, of the activation electrolyte towards the suction nozzle of the motor-driven pump, in order to generate closed-loop circulation of the activation electrolyte in the main electrical cell during the cruise phase.

6. Electrical cell according to claim 4 or 5, characterized in that said thermostatic valve is formed by a three-way valve receiving:

- a direct flow of activation electrolyte drawn from said second chamber forming a reservoir,
- a derivative flow of activation electrolyte passing by way of a heat exchanger, the derivative flow being maintained at a substantially constant temperature by said heat exchanger, said thermostatic valve delivering, from said direct flow and said derivative flow at a substantially constant temperature acting as a reference temperature, a flow of thermostatically-controlled activation electrolyte at a substantially constant temperature to the internal cavity of said main electrical cell.

7. Electrical propulsion cell according to any one of claims 1 to 6, characterized in that said main electrical cell of the electrochemical type is an AgO-Al cell.

8. Electrical propulsion cell according to claims 4 and 7, characterized in that said main electrical cell of the electrochemical type is formed by:

- an electrochemical block constituted by a stack of AgO-Al electrochemical couples located in the cavity of a sealed module connected, on the one hand, to said thermostatic valve and, on the other hand, to said device for the circulation of the electrolyte;
- a reserve of anhydrous sodium hydroxide, said electrochemical block and said reserve of anhydrous sodium hydroxide being located in said second chamber forming a reservoir.

9. Electrical propulsion cell according to claim 8, characterized in that said anhydrous sodium hydroxide reserve is constituted by a mixture of micropellets of anhydrous sodium hydroxide and powder-form stannates charged in bulk into said second chamber forming a reservoir.

10. Electrical propulsion cell according to any one of claims 1 to 9, characterized in that said sealed cell body is formed by an assembly of elements constituted at least by:

- a front collar;
- a front end of the main electrical cell, said front collar and said front end forming said third chamber;
- a central shell;
- a rear end, said front end, said central shell and said rear end forming said second chamber;
- a rear collar, said rear end and said rear collar forming said first chamber.

11. Electrical propulsion cell according to claim 10, characterized in that said central shell at least is constituted by a metal alloy which is a good heat conductor, a portion at least of said central shell which is located in the vicinity of said main electrical cell constituting a heat exchanger with said aquatic medium, to form a heat exchanger for at least a derivative flow of activation electrolyte.

12. Electrical propulsion cell according to either claim 10 or claim 11, characterized in that the front collar, the front end of the electrical cell, the central shell, the rear end of the electrical cell and the rear collar are composed of a metal material, the external face thereof which is to be in contact with the aquatic medium being provided with a protective anti-corrosion layer obtained by hard anodic oxidation.

13. Electrical propulsion cell according to any one of claims 10 to 12, characterized in that the internal face of the front end of the electrical cell, of the central shell and of the rear end of the electrical cell constituting said second chamber forming a reservoir comprise a chemical nickel coating for protection against corrosion by the anhydrous sodium hydroxide.

14. Electrical propulsion cell according to any one of claims 11 to 13, characterized in that the internal face of said central shell, except for the portion forming the heat exchanger, also comprises a thermally insulating coating at the portion forming a reservoir for the activation electrolyte, in order to reduce the cooling of the stored activation electrolyte by heat exchange with the aquatic medium during the cruise phase.

15. Electrical propulsion cell according to any one of claims 10 to 14, characterized in that said sealed cell body is provided with a double sealing barrier with respect to said aquatic medium:

- a first sealing barrier formed by a seal between the aquatic medium and the first chamber, and the third chamber respectively;
- a second sealing barrier formed by a seal between the first and second chamber and the second and third chamber, respectively.

16. Electrical propulsion cell according to any one of claims 10 to 15, characterized in that it also comprises:

- a plurality of temperature sensors for the flow of activation electrolyte entering and leaving the main electrical cell, in order to be able to regulate the temperature of the flow of activation electrolyte by means of said thermostatic valve;
- a plurality of sensors for sensing the relative pressure of the activation electrolyte in the second chamber forming a reservoir, of the activation electrolyte at the inlet of the device for the circulation of the activation electrolyte and for the separation of the effluents, said sensors of relative pressure delivering a relative pressure value with respect to the pressure outside the sealed cell body;
- a plurality of contacts, a contact for sealing the valve for the admission of water from the aquatic medium, a contact for opening the valve for the admission of water to the sealed cell body.

17. Electrical propulsion cell according to any one of claims 10 to 16, characterized in that the front collar, the

central shell and the rear collar have a substantially cylindrical cross-section of revolution.

18. Electrical propulsion cell according to claim 17, characterized in that the front collar and the rear collar have a distal end which is open with respect to the front end and the rear end, respectively, of the cell in order to construct said electrical propulsion cell, on the one hand, in the form of an independent module which can be stored as a substantially inert component with its charge of anhydrous sodium hydroxide reserve when the electrical propulsion cell is not mounted with the device, and, on the other hand, in the form of an element integrated directly in the body of the device, the distal end of said front collar being secured mechanically and coupled electrically to an active portion of the device and the distal end of the rear collar being secured mechanically and coupled electrically to the propulsive and control rear portion of the device in order to constitute an electrical propulsion cell which can be activated as soon as the device is launched.

19. Use of an electrical cell for the propulsion of a device in an aquatic medium according to any one of claims 1 to 18 for the supply of power to, the propulsion and the control of a device, such as a torpedo, a reconnaissance submarine or a surface device.